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EXECUTIVE OFFICE OF HEALTH AND HUMAN SERVICES  
DEPARTMENT OF PUBLIC HEALTH

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**CANCER INCIDENCE in MASSACHUSETTS  
1995 - 1999:  
City and Town Supplement**

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Bureau of Family and Community Health  
Cancer Prevention and Control..... 617-624-5070

Massachusetts Department of Public Health website..... [www.state.ma.us/dph](http://www.state.ma.us/dph)

- for U.S. data, information on treatment and screening, and further information on risk factors:

National Cancer Institute, Cancer Information Service..... 1-800-422-6237

National Cancer Institute website..... [www.cancer.gov](http://www.cancer.gov)

American Cancer Society, New England..... 1-800-227-2345

American Cancer Society website..... [www.cancer.org](http://www.cancer.org)

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# INTRODUCTION

## Content

The purpose of this report is to provide standardized incidence ratios for twenty-three types of cancer in the 351 cities and towns of Massachusetts for the five-year time period 1995 through 1999. The report is organized into the following six sections:

- **City / Town Cancer Incidence** summarizes the data tabulated in this report.
- **Methods** provides a detailed explanation of the data collection, data processing and statistical techniques employed in this report.
- **TABLES** presents data for selected types of cancer by city/town and sex.
- **Appendix I** provides a listing of International Classification of Diseases for Oncology codes used for the preparation of this report.
- **APPENDIX II** provides a listing of risk factors for selected cancer types and a listing of the individuals who reviewed the risk factor list.
- **APPENDIX III** describes current Massachusetts Department of Public Health efforts to reduce the risk of specific cancers and a list of related educational materials.

## Comparison with Previous Reports

This report updates previous annual reports published by the Massachusetts Cancer Registry (MCR). Hard-copy versions of such reports are published every five years, and on-line versions are updated annually. The data contained in this on-line report are also available by contacting the MCR:

MDPH  
Mass. Cancer Registry  
250 Washington St / 6th Flr  
Boston, MA 02108-4619  
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The preceding report, **1994-1998 City and Town Supplement**, included data for diagnosis years 1994 through 1998, while this report contains data for 1995 through 1999. There have been no changes in this report's format.

Information on cancer control programs of the Massachusetts Department of Public Health is available in Appendix III of this report and elsewhere on the Department's website ([www.state.ma.us/dph/cancerct/home.htm](http://www.state.ma.us/dph/cancerct/home.htm)). Cancer incidence and mortality data are also available through MassCHIP (<http://masschip.state.ma.us>), the Department's Internet-based public access information service, which provides users with detailed health data on a variety of geographic levels while protecting data confidentiality.

It is important to note that the standardized incidence ratios (SIRs) presented in this report **cannot be compared** with SIRs in the **1994-1998 City and Town Supplement** because the numbers of expected cases used to calculate SIRs in the earlier publication were based on 1996 city/town population estimates; in this report, the city/town population estimates used to calculate expected case counts were for 1997. See **Expected and Observed Case Counts** on page 5 for further information.

# CITY / TOWN CANCER INCIDENCE, 1995 - 1999

## Content

Each city and town in Massachusetts is listed alphabetically in the **TABLES** section. The expected number of cases, the observed number of cases, and standardized incidence ratios are presented for twenty-three types of cancer and for all cancers combined.<sup>1</sup>

Next to the number of observed cases for each cancer type in a city/town is the corresponding SIR. Any SIR value that is not followed by a symbol described below is not statistically significant at the levels of significance testing used in this report.

A pound symbol ( # ) following an SIR value indicates that this cancer incidence excess (#+) or deficit (#-) is statistically significant at the  $p \leq 0.05$  level.

A tilde symbol ( ~ ) following an SIR indicates that this cancer excess (~+) or deficit (~-) is statistically significant at the  $p \leq 0.01$  level.

A caret symbol ( ^ ) following an SIR indicates that this cancer excess (^+) or deficit (^-) is statistically significant at the  $p \leq 0.001$  level.

(See **Measures of Statistical Significance** on page 6 for a detailed discussion of the significance testing used in this report.)

Whenever the number of observed cases was less than five, the corresponding SIR was neither calculated nor tested for statistical significance; this is indicated with an SIR of "not calculated" followed by an asterisk (NC\*). The number of observed and expected cases *is* shown in these circumstances.

## Interpretation of the Data

*The information contained in this report and in the data tables does not provide proof of the association of individual risk factors with cancer excesses in any town, but rather should be used as a guide for further surveillance, epidemiologic investigations, and other public health activities.*

When reviewing the data tables, it is important to keep in mind that an SIR compares the observed cancer incidence in a particular community with the expected incidence based on statewide average age-specific incidence rates. This means that *valid comparisons can only be made between a community and the state as a whole. SIRs for different cities and towns **cannot** and **should not be compared to each other**.* (Comparisons between two communities would be valid only if there were no differences in the age and sex distributions of the two communities' populations.)

## METHODS

### Data Collection

The MCR collects reports of all newly<sup>2</sup> diagnosed cancer cases from all Massachusetts acute care hospitals and one health maintenance organization (79 reporting facilities in 1999). The MCR compiles summaries of cancer incidence, such as this report, and also produces special reports. These undertakings require data collection efforts that necessitate extensive interaction with hospital tumor registrars. Intensive data evaluation is also required to ensure data quality. The fundamental requirements of any central cancer registry include: (1) complete registration, (2) prevention of case duplication, (3) collection of uniform data, i.e., standardization of items, definitions, rules, classification and nomenclature of primary site, histology, staging and procedures, (4) quality control, and (5) efficient data processing.

MCR case ascertainment improved during the years covered by this report. For diagnosis year 1999, the MCR's total case count was estimated (by the North American Association of Central Cancer Registries) to be complete. This report includes (for the diagnosis years indicated) two case sources that were not available for most previous editions of the *City and Town Supplement* -- physician office cases reported by hospitals and death certificate-only cases:

For diagnosis years 1996 and onward, the MCR collects information from reporting hospitals, where available, on cases diagnosed and treated in staff physician offices. Not all hospitals report this type of case, however, and some hospitals report such cases as if the patients had been diagnosed and treated by the hospital directly. Collecting this type of data makes the MCR's overall case ascertainment more complete, but because these cases are not reported by every hospital, there will be effects on the reporting completeness in some geographic areas. If a certain hospital reports physician office cases to the MCR and mainly serves patients living in one geographic region of the state, for example, the case collection of that region's cancers may be slightly more complete than that of other regions where hospitals do not report physician office cases. The cancer types most often reported to the MCR in this manner are prostate cancers and melanomas.

For diagnosis years 1997 through 1999, the MCR identified previously unreported cancer cases through death certificate clearance to further improve case completeness. In some instances a cancer-related cause of death recorded on a Massachusetts death certificate is the *only* source of information for a cancer case.

These "death certificate-only" cancer diagnoses are therefore poorly documented and have not been medically confirmed (confirmed by review of complete clinical information). Such cases are included in this report for diagnosis years 1997, 1998 and 1999; they comprise approximately 2% of all cancer cases for these years.<sup>3</sup>

Coding for cancer types in this report follows the International Classification of Diseases for Oncology (Second Edition) system (see **Appendix I** on page 365). The list of reportable neoplasms is essentially the same as that used for the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program data, with the exception of *in situ* neoplasms. The MCR began collecting information on *in situ* neoplasms diagnosed as of January 1, 1992; however, *in situ* cases are **not** included in this report. You may contact the MCR for information on *in situ* neoplasms.

The data summarized in this report are drawn from data entered on MCR computer files on or before June 3, 2002. The numbers presented in this report may change slightly in future reports, reflecting late reported cases, address corrections, or other changes based on subsequent details from reporting facilities. Furthermore, as health researchers may use these data to meet a diverse range of needs, they

may produce results slightly different from those published herein. Using slightly different population estimates or statistical methodologies, such as grouping ages differently or rounding off numbers at different points during calculations, may also produce results slightly different from those published in this report.

## Data Presentation

Three measures of cancer incidence are presented in this report's data tables: expected case counts, observed case counts, and standardized incidence ratios (SIRs).

### ***Expected and Observed Case Counts***

A city/town's *expected* case count (**Exp**) for a certain type of cancer for this time period is a calculated number based on that city/town's population distribution (by sex and among six age groups) for 1997 (the midpoint of 1995 through 1999), and the corresponding statewide average age-specific incidence rates. See ***Calculation of an SIR*** (page 7) for an example of how a hypothetical expected count is calculated. The expected case counts in this report are rounded to the nearest hundredth (two decimal places); if the total expected case count is not exactly equal to the sum of the male and female expected counts, this is attributable to rounding error.

For the computation of statewide average age-specific incidence rates used for this report, the 1997 statewide population estimates (by sex and six age groups) were obtained from the Massachusetts Institute for Social and Economic Research (MISER)<sup>4</sup>. Different methodologies may be used to derive slightly different population estimates, yielding slightly different results.

In this report, the *observed* case count (**Obs**) for a particular type of cancer in a city/town is the actual number of newly<sup>5</sup> diagnosed cases reported to have been diagnosed in residents of that city/town from 1995 through 1999. The "Total" observed case count for each cancer type is the sum of the number of observed male and female cases only. The MCR added two additional gender classifications (transsexuals and persons with sex chromosome abnormalities/hermaphrodites) for cases diagnosed as of January 1, 1995. (Cases diagnosed before this date were limited to male or female only.) Any case classified in either of the new gender categories<sup>6</sup> is *not* included in this report because the population data used in the statistical calculations include only male and female categories.

### ***Standardized Incidence Ratios***

The data tables present SIRs (rounded to the nearest whole number) for males, females and the total population of each city/town for twenty-three types of cancer and for all cancers combined. An SIR is an indirect method of adjustment for age and sex that describes in numerical terms how a city/town's average experience in 1995-1999 compared to that of the state as a whole. The SIR is a useful tool for screening incidence data and generating leads for further public health investigations.

- An SIR of *exactly 100* indicates that a city/town's incidence for a certain type of cancer is *equal to that expected* based on statewide average age-specific incidence rates.
- An SIR of *more than 100* indicates that a city/town's incidence for a certain type of cancer is *higher than expected* for that type of cancer based on statewide average age-specific incidence rates. For example, an SIR of 105 indicates that a city/town's cancer incidence is 5% higher than expected based on statewide average age-specific incidence rates.
- An SIR of *less than 100* indicates that a city/town's incidence for a certain type of cancer is *lower than expected* based on statewide average age-specific incidence rates. For example, an SIR of 85 indicates that a city/town's cancer incidence is 15% lower than expected based on statewide average age-specific incidence rates.

## Measures of Statistical Significance

Tests of statistical significance allow an estimate of the probability (referred to as a "p" value) that the difference between the observed and expected case count is due to chance alone. A p value of less than or equal to 5% ( $p \leq 0.05$ ) means that there is, at most, a 5% chance that the difference between the observed and expected case count is due to chance alone; thus, a cancer excess or deficit with such a p value is considered statistically significant. *The presence or absence of statistical significance does not necessarily imply biological or public health significance.*

In this report, three levels of statistical significance are employed to identify cities and towns with excess cancer incidence (and deficits) as compared with statewide average incidence --  $p \leq 0.05$ ,  $p \leq 0.01$ , and  $p \leq 0.001$ . The use of  $p \leq 0.001$  highlights those cancer excesses least likely to have occurred by chance alone. Use of this stringent criteria, however, makes it difficult to identify elevated SIRs for towns with relatively small populations and small numbers of cancer cases. The use of  $p \leq 0.05$  constitutes a less stringent criterion and identifies a greater number of cancer excesses. Use of  $p \leq 0.05$  can provide investigators with a broader context for identifying patterns of excess cancer incidence than use of  $p \leq 0.01$  or  $p \leq 0.001$ .

**$p \leq 0.05$ :** In the data tables,  $p \leq 0.05$  is used to identify cancer types having significant excesses or deficits at the least stringent level used herein --  $p \leq 0.05$ . This indicates that there is, at most, 1 chance in 20 that the identified excess or deficit of cancer cases is due to chance alone. A pound symbol (#) following an SIR marks that excess or deficit as statistically significant at the  $p \leq 0.05$  level, but not at the higher levels ( $p \leq 0.01$  and  $p \leq 0.001$ ). Based on the number of tests performed for this report (eighteen male/female sites and five single-sex sites), one would expect by chance alone to find 360 significant excesses at this p level; 365 were found.

**$p \leq 0.01$ :** A p value of less than or equal to 0.01 indicates that there is, at most, 1 chance in 100 that the excess or deficit of cancer cases is due to chance alone. (All cancer excesses and deficits which are statistically significant at this level are also significant at the less stringent  $p \leq 0.05$  level, but not all data significant at the  $p \leq 0.05$  level are significant at the  $p \leq 0.01$  level.) A tilde symbol (~) following an SIR indicates that these data are significant at both the  $p \leq 0.05$  and  $p \leq 0.01$  levels, but not at the more stringent  $p \leq 0.001$  level. Based on the number of tests performed for this report, one would expect by chance alone to find 72 significant excesses at the  $p \leq 0.01$  level; 152 were found.

**$p \leq 0.001$ :** This is the most stringent criterion employed in this report to highlight cancer excesses and deficits that are least likely to be due to chance alone. This p value indicates that there is, at most, 1 chance in 1000 that the excess or deficit in observed cases is due to chance alone. A caret symbol (^) following an SIR indicates that these data are significant at all three levels of significance testing used here. Based on the number of tests performed for this report, one would expect by chance alone to find 7 significant excesses at the  $p \leq 0.001$  level; 50 were found.



### **Calculation of an SIR**

$$\text{SIR} = \frac{\text{OBSERVED}}{\text{EXPECTED}} \times 100$$

The following example illustrates the method of calculation for a hypothetical town for one type of cancer for the year 1997:

<b>Age Group</b>	<b>Town X Population</b>	<b>State Age-Specific Incidence Rate</b>	<b>Town X Expected Cases</b>	<b>Town X Observed Cases</b>
	(A)	(B)	(C) = (A) x (B)	(D)
<b>0-19</b>	74,657	0.0001	7.47	11
<b>20-44</b>	134,957	0.0002	26.99	25
<b>45-64</b>	54,463	0.0005	27.23	30
<b>65-74</b>	25,136	0.0015	37.70	40
<b>75-84</b>	17,012	0.0018	30.62	30
<b>85+</b>	6,337	0.0010	6.34	8
			<b>total: 136.35</b>	<b>144</b>

$$\text{SIR} = \frac{\text{Observed Cases}}{\text{Expected Cases}} \times 100 = \frac{(\text{column D total})}{(\text{column C total})} \times 100 = \frac{144}{136.35} \times 100 \sim 106$$

Thus the SIR for this type of cancer in Town X is 106, indicating that the incidence of this cancer in Town X is approximately 6% higher than the corresponding statewide average incidence for this cancer.

### **Data Limitations**

It should be remembered that apparent increases or decreases in cancer incidence over time may reflect changes in diagnostic methods or case reporting rather than true changes in cancer incidence. Three other limitations must be considered when interpreting cancer incidence data for Massachusetts cities and towns: under-reporting in areas close to neighboring states; under-reporting for cancers that may not be diagnosed in hospitals; and cases being assigned to incorrect cities/towns.

### **Border Areas and Neighboring States**

Some areas of Massachusetts appear to have low cancer incidence, but this may be the result of under-reporting -- that is, a loss of cases diagnosed or treated in neighboring states that are not reported to the MCR. Presently the MCR has reciprocal reporting agreements with fifteen states -- Alaska, Arkansas, Connecticut, Florida, Maine, Mississippi, New Hampshire, New York, North Carolina, Rhode Island, South Carolina, Texas, Vermont, Wisconsin and Wyoming.

### **Cases Diagnosed in Non-Hospital Settings**

During the time period covered by this report (1995 through 1999), the MCR's information sources for nearly all cancer cases were hospitals. Some types of cancer in this report are undoubtedly under-reported because they may be diagnosed by private physicians, private laboratories, health maintenance organizations or radiotherapy centers that escape hospital case identification systems. Examples may include melanoma of skin, prostate cancer, and certain hematologic malignancies such as leukemia and

multiple myeloma. The extent of this under-reporting has not been determined exactly, but cases included in this report represent the great majority of actual cases and provide an essential basis for observing cancer incidence patterns. (See page 4 in **Data Collection** for a discussion of cases diagnosed and treated in physician offices and reported by hospitals.)

### ***City/Town Misassignment***

In accordance with standard central cancer registry procedures, each case reported to the MCR should ideally be assigned to the city/town in which the patient lived at the time of diagnosis, based on the address provided by the reporting hospital. In practice, however, a patient may provide the hospital with his/her mailing address (e.g., a post office box located outside the patient's city/town of residence); a business address; a temporary address (e.g., the patient is staying with a relative while receiving treatment and reports the relative's address as his/her own); or a locality or post office name (e.g., "Chestnut Hill" rather than "Boston", "Brookline" or "Newton"). In addition, if a patient has moved since being diagnosed, the hospital may report the patient's current address. Because of the large number of cases reported to the MCR, and because data are reported to the MCR via electronic media, most city/town case assignments are performed by an automated computer process. This simplified matching process may misassign some cases based on the reported locality name. When MCR staff become aware of such misassignments, the errors are corrected manually. Furthermore, in order to minimize such errors, cases from fifty geographic localities prone to city/town misassignment are reviewed manually by the MCR.

### **Footnotes:**

1 The number of cases for a certain type of cancer is not necessarily equivalent to the number of *people* with that type of cancer. A single person may contribute multiple cases to an observed number of cases.

2 In keeping with national data standards, the recurrence of a previously diagnosed cancer should also be reported to the MCR in certain circumstances.

3 The death certificate review process also identifies some cancer cases that are found to have been diagnosed before death but are not reportable to the MCR; such cases are not added to MCR databases and are not included in this report. The process also identifies some cancer cases that were diagnosed before death and should have been reported to the MCR; these previously "missed" cases are added to MCR data files for the appropriate diagnosis year and are included in this report for 1995-1999.

4 The MISER population estimates for 1997 were released November 1999.

5 In certain circumstances the recurrence of a previously diagnosed cancer is also included here.

6 Twenty-five cases classified in the new gender categories are recorded at the MCR for 1995-1999.

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